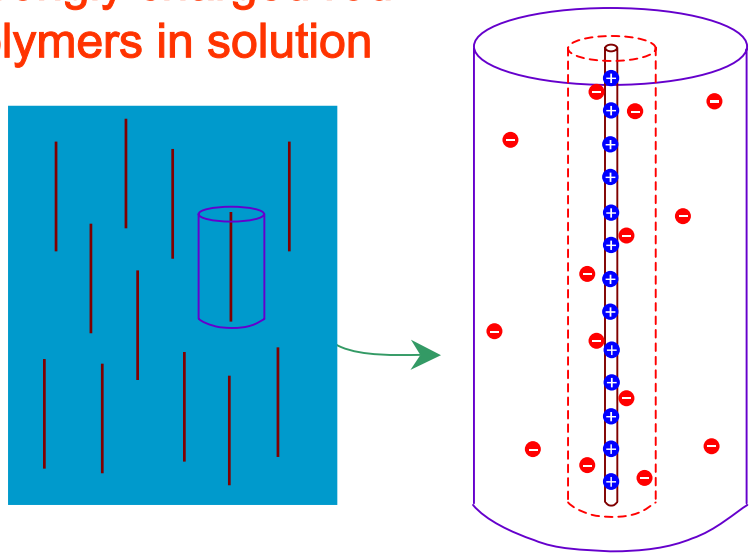
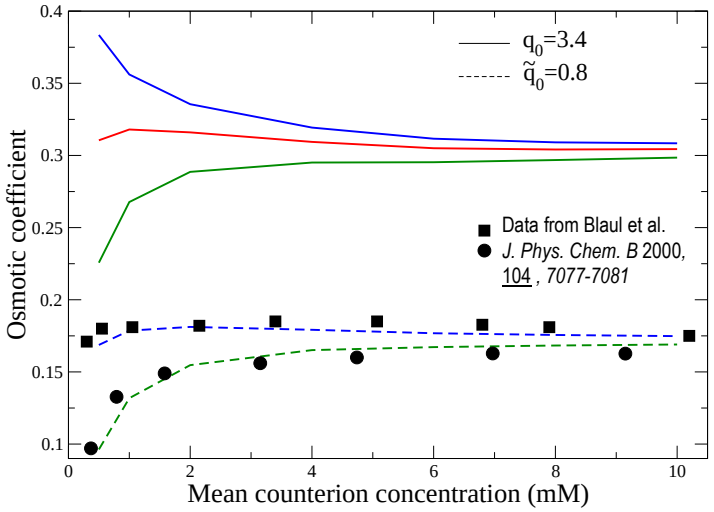
Theory of Strongly Charged Polymers in Bulk and on Surfaces

Ben O'Shaughnessy, **Columbia University**, DMR-9816374

Strongly charged rod polymers in solution





Osmotic Pressure

- Classic example: ***DNA solutions***
- Individual rods: ***Manning condensation*** (Manning, 1969) – fraction of counterions condense onto rod if sufficiently charged
- Our research : many rods. What fraction of Manning condensate is released?
- Applications: ***DNA hybridization***, ***ligand binding***, ***polymerase chain reaction***, etc.

- Our theory predicts osmotic pressure dependence on polymer and salt concentrations
- ***Evaporation*** of condensate determines osmotic pressure
- Agrees well with experiments when ***local structural effects*** included

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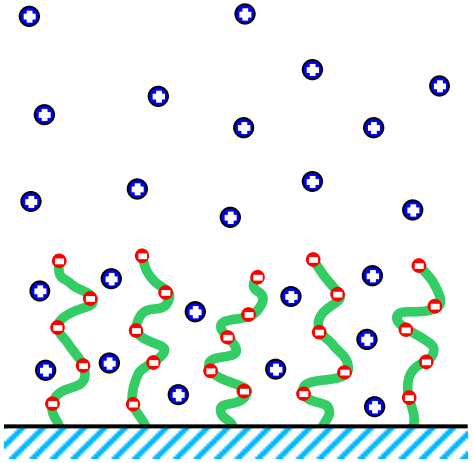
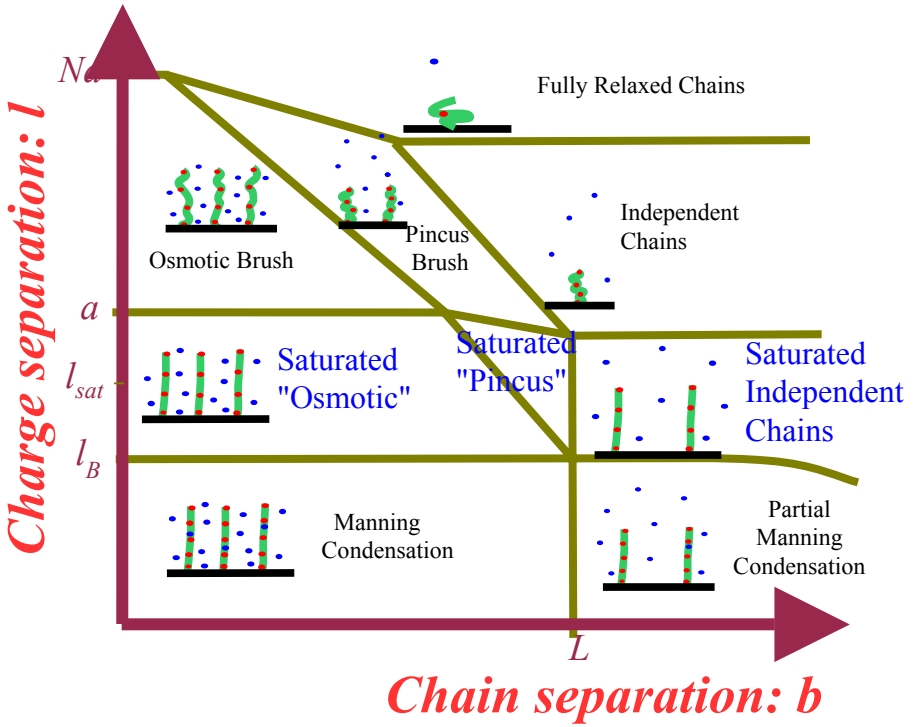
Strongly charged polymers on surfaces



- Example of enormous biotechnological importance: *DNA microarrays*
- Layer structure determines biosensor properties
- Other applications: *Colloidal suspensions*, *surface modification*, *lubrication*.

Trained researcher:
Qingbo Yang (graduate student)



- Our research: complete *phase diagram* of layer structures
- *Strongly charged* polymers can become non-linearly stretched
- Phase diagram qualitatively different to *weakly charged* case